Report on Regional Workshops in Asia, Africa and Latin America for Evaluation of Pre-Release Versions of the Final NuMaSS Software

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SM-CRSP Project *Decision Aids for Integrated Nutrient Management*

Background

Throughout the 5-year development of the Nutrient Management Support System (NuMaSS) software we have welcomed ideas and suggestions from the project's extensive network of collaborators in National Agricultural Research and Extension Services, International Research Centers, agri-business and other CRSP projects in tropical regions of Africa, Asia and Latin America. Collaborator input began in 1997 with development of a paper prototype of the software during a Project Planning Workshop which included representatives from the intensive testing sites in Costa Rica, Mali and Philippines. In September 1999, near the project's mid-term, an initial prototype of the software was released during the Workshop on Decision Processes for Determining Diagnostic and Predictive Criteria for Soil Nutrient Management, held at the Philippine Rice Research Institute's headquarters with co-sponsorship by IRRI and the SM-CRSP (Osmond et al., 2000). The fifty-seven participants who attended the five-day workshop included representatives from the U.S. and 19 countries in tropical regions of Africa, Asia and Latin America. During the workshop participants evaluated the initial version of NuMaSS and provided a list of recommendations to improve function and accuracy of the software.

Software development during the final two years of the project entailed both revisions as suggested by collaborators and the incorporation new knowledge and information acquired simultaneously through field, greenhouse, laboratory and literature research as outlined in the project's annual workplans. New crops have been added to the software, including heart-of-palm production from peach palm as the test tree crop. Soil and crop coefficients have been revised and updated. There is greater integration across acidity, nitrogen and phosphorus in process of diagnosing a nutrient problem and recommending corrective measures than in the software prior versions. A new module for economics improves the evaluation of nutrient interactions.

A second round of workshops was held during the period of January - March 2002 to evaluate beta-versions of the NuMaSS software which will be released at the conclusion of the project. These events were organized as regional group meetings within Africa, Asia and Latin America instead of a single international workshop, as was done in 1999 in the Philippines. This report summarizes activities and outcomes for the three regional workshops.

Workshop Programs, Venues and Regional Participation

Regional workshops in Asia and Latin America were held in January and the workshop in Africa was held in March. Each workshop was co-sponsored and hosted by a collaborating institution: the Philippines Rice Research Institute at Maligaya, Philippines, the International Fertilizer Development Center (IFDC) - Africa in Lomé, Togo and the University of Costa Rica in Guápiles, Costa Rica.

Common program components for each 3-4 day workshop were the hands-on evaluation of beta-versions of the final NuMaSS software by participants, their assessments of the software's

strengths and weaknesses, and the potential relevance of the software to their own soil nutrient management programs. In each workshop, one-half to a full day was devoted to discussing and planning activities on the adoption of NuMaSS during the next 5-year phase of the SM-CRSP. All workshops also contained reports and discussions on the SM-CRSP project's activities within the respective regions: annual crop research and evaluation of NuMaSS predictions in Ilagan and Mindinao, Philippines; field testing of NuMaSS predictions, phosphate rock module development and soil organic matter management issues in Mali; and peach palm field research and tree crop module development in Costa Rica. Reports at each workshop on social and economic aspects of nutrient management summarized the findings from project evaluations in years 1, 3 and 5 at Guápiles - Costa Rica, Cinzana - Mali, and Ilagan - Philippines.

Draft copies of the presentations on nutrient management research in peach palm were provided to participants of the Latin American workshop. Meanwhile, collaborators at the University of Costa Rica are editing these reports for joint publication in a 2003 issue of the *Agronomia Costarricense* journal.

Each regional workshop also contained unique program components. In Costa Rica, a full day was devoted to tours of ongoing experiments with peach palm in both farmers' fields and research stations. In the Philippines and Africa participants described the existing approaches for nutrient diagnosis and predictions and their current constraints. The workshop in Togo also included evaluation of the QUEFTS software which is currently used by the COSTBOX project of IFDC - Africa.

Participants in the three workshops collectively represented 42 national and international institutions in 24 countries. Thirteen of the 65 participants had also attended the NuMaSS workshop held in 1999 at Maligaya, Philippines. Their presence in the regional workshops helped provide all participants with a historical background on the project and a reference point for NuMaSS software development since the last workshop.

Participant Comments and Suggestions on NuMaSS

Participants who attended the 1999 workshop were pleased that the long list of suggestions they provided after evaluating version 1.0 had been incorporated into the beta versions of NuMaSS 2.0. They noted that acidity, N and P constraints were addressed in a more integrated manner across the *Diagnosis*, *Prediction*, *Economics* and *Results* components of the software.

Many of the comments related to "user friendliness" of the software. These included the explanations and definitions available in the *Help* options, quality control warnings on input of data, and suggested default values for crops, soils, fertilizers and regional yield levels. Several participants felt that NuMaSS was an effective teaching tool and expressed plans to use it in their educational activities with a variety of audiences.

Concern was expressed at each workshop about the need to include consideration of soil K constraints in NuMaSS. By the third regional workshop, we became "well versed " in explaining how funding levels prevented development of a K component in the current 5-year grant and the SM-CRSP's preferred focus, during the next 5-year phase, on adoption of the existing software rather than additional development. Fortunately, one collaborator has secured funds to evaluate the literature and develop a prototype K algorithm, which will be tested in during the next 5-year phase of the SM-CRSP.

Several participants requested the addition of more crops to the 19 which are currently considered in NuMaSS. In the Latin American workshop there was considerable discussion about using the approach developed for heart-of-palm production with peach palm with other tree crops like coffee and banana. Although the research database for these crops are more abundant than for peach palm, a coordinated regional effort would be needed to assemble pertinent information, identify knowledge gaps and conduct measurements on critical components across a variety of soil, climate and management system combinations.

The workshops provided us with opportunities to observe and interact with individuals as they used the software and evaluated its performance with data for their location-specific conditions. This interaction and feedback has enabled us to identify and correct various aspects of the software prior to the final release. Some of the major adjustments are described in the following.

- *Economics* - this module was completely revised after the workshop in 1999. Evaluations during the three workshops identified several changes that were needed in the interface design to make requested input and results information clearer to the users.
- *Peach palm* - this tree crop component was also added since the workshop in 1999. Despite the limited data available on this crop's response to P fertilization, participants requested the inclusion of P information in the *Prediction* and *Economics* modules. Their argument was that inclusion of P in the final version of NuMaSS would enable them to refine the existing plant and soil coefficients through future field trials on this commodity. The positive reactions to the software's N component by members of peach palm grower cooperatives in Costa Rica was a good "acid test" of the knowledge base addressing this nutrient constraint.
- *Tuber crops* - participants made several suggestions and contributed data which led to improvements of N and P predictions.
- *Soil P coefficients* - in clayey soils existing algorithms in NuMaSS often predicted soil P critical levels and P buffer coefficients that deviated from measured values. One of the limitations to correcting this problem was the paucity of data for soils with medium to high clay content. During the regional workshop in the Philippines a detailed report was presented on the long-term P experiments carried out in Asia with the support of the IRRI Uplands Consortium during the previous six years. Combination of these data with existing data sets enabled development of new algorithms whose predicted values are a closer match to the observed field measurements.

Potential Applications of NuMaSS

A common theme among the potential applications of NuMaSS elicited during the workshops was the need for validation of software predictions under local soil, crop, climate and economic conditions. Although most participants agreed that the software would be useful in their teaching, research or extension activities related to nutrient management, several noted that existing economic and/or policy issues in their regions were greater constraints than improved nutrient management *per se.*

The most common potential applications for the software included

- undergraduate and graduate courses on soil nutrient management,
- determination of nutrient levels and sources in the design of field trials,

- economic assessment of existing nutrient recommendations,
- interpretations and recommendations for soil testing labs,
- improving information transfer between research and extension, and
- improving local expertise in the diagnosis of soil nutrient problems.

Two collaborators in SE Asia (Philippines and Thailand) have secured their own funds to carry out field tests of the algorithms used in NuMaSS, and another has such a project nearly funded. Several collaborators in Latin America have secured partial funding to complement SM-CRSP technical backstopping support for their local tests on NuMaSS adoption. These future activities indicate that the concepts and algorithms used in NuMaSS are stimulating local interest.

Aknowledgements

We wish to recognize and offer a special thanks to the host institutions for each of the workshops - the Center for Agronomic Investigations at the University of Costa Rica, the Philippine Rice Research Institute, the International Rice Research Institute, and the International Fertilizer Development Center/Africa. They invested extensive amounts of resources and personnel in logistical preparations and support during the events. Their contributions were essential to the achievement of the workshops' goals and objectives.

Literature Cited

Osmond, D.L., T. Metra-Corton., T.J. Smyth, R.S. Yost and W.S. Reid (eds.). 2000. Decision Processes for Determining Diagnostic and Predictive Criteria for Soil Nutrient Management: proceedings of the workshop on 6-10 September 1999 at Maligaya, Muñoz, Nueva Ecija, Philippines. U.S. Agency for International Development - Soil Management Collaborative Research Support Program. SM-CRSP Tech. Bul. No. 2000-03. Philippine Rice Res. Inst., Maligaya, Philippines. 132 pp.

Appendix A
Latin American Regional Workshop Program and Participants
Guápiles, Costa Rica, 6 -10 January, 2002

Program

January 6

Participant arrival in San Jose and transport to Hotel Suerre in Guápiles

January 7

Opening Ceremonies

8:00 - 8:20	Welcome - Renan Aguero and Charles Sloger
8:20 - 8:40	Introduction of Participants - Alfredo Alvarado
8:40 - 9:00	Description of workshop objectives and program - Jot Smyth

Structure, Development and Operation of the NuMaSS Software

9:00 - 9:30	Structure: diagnosis, prediction, economics and guidance - Deanna Osmond
9:30 - 10:00	Criteria for addressing soil acidity, N and P constraints - D. Osmond & J. Smyth
10:00 - 10:30	Break
10:30 - 11:00	Database development - D. Osmond
11:00 - 11:30	Integration of nutrient management: economics - D. Osmond
11:30 - 12:00	Discussion
12:00 - 1:30	Lunch

Participant's Evaluation of the NuMaSS Software

1:30 - 4:00	Participants work with NuMaSS using their data
4:00 - 5:00	Group assessment of NuMaSS performance: strengths and weaknesses

January 8

Field Trip

8:00 - 11:00	On-farm trials in Ultisols to evaluate NuMaSS diagnosis for peach palm - Jimmy Boniche, Danilo Alpizar & A. Alvarado
11:00 - 12:00	Observation of the INDACO peach palm plantation and Ultisol profiles - J. Boniche & A. Alvarado

12:00 - 1:00 'La Leona' peach palm farm on Andisols -D. Alpizar & A. Alvarado

1:30 - 2:30 Lunch

2:30 - 5:00 Tour of peach palm field research at 'Los Diamantes' Experiment Station - Carlos Arroyo, Antonio Bogantes, A. Alvarado & J. Boniche

January 9

Nutrient Management Research for Heart-of-palm Production Systems with Peach Palm

8:00 - 8:30 Definition of growth stages - Adrian Ares

8:30 - 9:00 Biomass, nutrient balances, and nutrient cycling in mature stands - J. Smyth

9:00 - 9:30 Phosphorus requirements and growth responses at nursery and mature growth stages - A. Ares

9:30 - 10:00 Nitrogen requirements and growth responses in mature stands - Eloy Molina

10:00 - 10:30 Break

10:30 - 11:00 Soil acidity management - Rafael Salas

Assembly of Heart-of-palm Information into NuMaSS

11:00 - 11:20 Diagnosis - J. Smyth

11:20 - 11:40 Prediction - D. Osmond & A. Ares

11:40 - 12:00 Economics - D. Osmond

12:00 - 1:30 Lunch

1:30 - 2:00 Socio-economic characteristics of 'palmito' nutrient management in Costa Rica - Frank Smith

Potential Applications for NuMaSS in Latin America

2:00 - 2:20 Bolivia - Armando Ferrufino

2:20 - 2:40 Brazil - Manoel Cravo & Newton Falcão

2:40 - 3:00 Costa Rica - R. Salas

3:00 - 3:40 Break

3:40 - 4:00 Ecuador - Francisco Mite

4:00 - 4:20 Mexico - Jaime Salinas

4:20 - 4:40 Panama - Benjamin Name

4:40 - 5:00 Closing Ceremonies - A. Alvarado & C. Sloger

January 10

Participant departure for San Jose airport

Participants

Name	**Country**	**Institution**
Antonio Bogantes	Costa Rica	Ministry of Agriculture
Carlos Arroyo	Costa Rica	University of Costa Rica
Jorge Mora Urpí	Costa Rica	University of Costa Rica
Clemente Zamora	Costa Rica	'Palmito' Cooperative
Rafael Segura	Costa Rica	Banana Cooperative
Noberto Durán	Costa Rica	'Palmito' Cooperative
Alfonso Vargas	Costa Rica	Banana Cooperative
Eloy Molina	Costa Rica	University of Costa Rica
Rafael Salas	Costa Rica	University of Costa Rica
Alfredo Alvarado	Costa Rica	University of Costa Rica
Jimmy Boniche	Costa Rica	University of Costa Rica
Danilo Alpizar	Costa Rica	University of Costa Rica
Armando Ferrufino	Bolivia	DAI - N.C. State Univ.
Newton Falcão	Brazil	INPA
Manoel Cravo	Brazil	EMBRAPA
Francisco Mite	Ecuador	INIAP
Jaime Salinas	Mexico	INIFAP
Benjamin Name	Panama	IDIAP
Adrian Ares	U.S.	USDA-ARS
Margoth Andrews	Honduras	Zamorano
Deanna Osmond	U.S.	N.C. State Univ.

Name	Country	Institution
Frank Smith	U.S.	N.C. State Univ.
Jot Smyth	U.S.	N.C. State Univ.
Lloyd Hossner	U.S.	Texas A&M Univ.
Charles Sloger	U.S.	USAID

Appendix B
Asian Regional Workshop Program and Participants
Maligaya, Philippines, 21 - 24 January, 2002

Program

January 21	
8:00 - 8:30	Registration
Opening Ceremonies	
8:30 - 9.45	Invocation & National Anthem - PhilRice Choir
	Welcome Remarks - Leocadio Sebastian
	Introduction of Participants - H. Gines
	The PhilRice Story
9:45 - 10:00	Break
10:00 - 10:15	Overview of the rice-based farming systems in fragile environment program - Madonna Casimero
10:15 - 10:30	Overview and expected output of the workshop - Russell Yost
10:30 - 12:00	Tour of PhilRice Laboratories and Experimental Field - H. Gines
12:00 - 1:00	Lunch
Country Reports on Nutrient Management Status	
1:00 - 1:30	Current nutrient management in Thailand - Taweesak Vearasilp
1:30 - 2:00	New soil testing program in Indonesia - Agus Sofyan
2:00 - 2:30	Open forum
2:30 - 3:00	Use of decision aids in on-farm experiments in Thailand - Tasnee Attanandana
3:00 - 3:15	Break
3:15 - 3:45	Current status of nutrient management in Vietnam - Pham Dung
3:45 - 4:15	Long-term phosphorus experiments in the Philippines - Angela Almendras
4:15 - 5:00	Open forum
January 22	

Summary of Phase I Work

8:00 - 8:30 Intensive testing of NuMaSS in the Philippines - Miguel Aragon

8:30 - 9:00 Extensive testing of NuMaSS in the Philippines - Jonathan Quiton

9:00 - 9:30 Open forum

9:30 - 9:45 Break

9:45 - 10:15 Baseline assessment of farm households in upland areas - Alicia Mataia

10:15 - 10:45 Impact evaluation of the NuMaSS project - J. Quiton

10:45 - 11:15 Extension activity and papers in Thailand - Kukiet Soitong

11:15 - 12:00 Open forum

12:00 - 1:00 Lunch

Updates on NuMaSS

1:00 - 1:30 Improvement of NuMaSS version 2.0 - Jot Smyth

1:30 - 3:30 Hands-on testing of NuMaSS

3:30 - 3:45 Break

3:45 - 4:30 Continued hands-on testing of NuMaSS

4:30 - 5:00 Wrap up

January 23

Workplan for Phase II

8:00 - 8:30 Reactions to NuMaSS version 2.0 - J. Quiton & J. Smyth

8:30 - 9:00 Proposed phosphate rock module for PDSS - R. Yost

9:00 - 9:30 Open forum

9:30 - 9:45 Break

9:45 - 10:15 Barangay rice seed production project - A. Versallo

10:15 - 10:45 Community organized rice farming - R. Lara

10:45 - 12:00 Open forum

12:00 - 1:00 Lunch

Workshop for Phase II

1:00 - 1:30	Phase II status and work - R. Yost
1:30 - 2:00	Individual Country discussion
2:00 - 3:15	Group discussion I - Indonesia & Philippines II - Laos, Thailand & Viatnam
3:15 - 3:30	Break
3:30 - 4:30	Group discussion I - Philippines & Thailand II - Indonesia, Laos & Vietnam
4:30 - 5:30	Discussion outcomes & wrap up

January 24

Presentation of Workshop Output

8:00 - 8:45	Indonesia
8:45 - 9:30	Laos
9:30 - 10:15	Vietnam
10:15 - 11:00	Thailand
11:00 - 11:45	Philippines
11:45 - 12:00	Wrap up
12:00 - 1:00	Lunch
1:00	Participant departure for Manila

Participants

Name	**Country**	**Institution**
Aguswarman	Indonesia	Sukarami Assessment Institute for Agric. Technology
Angela Almendras	Philippines	Leyte State Univ.
Miguel Aragon	Philippines	Central Luzon State Univ.
Tasnee Attanandana	Thailand	Kasetsart Univ.

Name	Country	Institution
Madonna Casimero	Philippines	Philippine Rice Res. Inst.
Pham Tien Dung	Vietnam	Hanoi Agric. Univ.
Rodolfo Escabarte	Philippines	Philippine Rice Res. Inst.
Thomas George	Philippines	IRRI
Josefina Lasquite	Philippines	Philippine Rice Res. Inst.
Bonifacio Macarubbo	Philippines	LGU-DA Ilagan
Cesar Mamaril	Philippines	Philippine Rice Res. Inst.
Alicia Mataia	Philippines	Philippine Rice Res. Inst.
Federico Perez	Philippines	Central Luzon State Univ.
Jonathan Quiton	Philippines	IRRI
Olayvanh Singvilay	Laos	Nationa Agric. And Forestry Center
R. K. Singh	India	Central Rainfed Upland Rice Res. Station
Jot Smyth	U.S.	N.C. State Univ.
Kukiet Soitong	Thailand	Dept. Agric. Extension
Agus Sofyan	Indonesia	Center for Soil and Agro-Climate Res.
Taweesak Vearasilp	Thailand	Dept. Land Development
Ricardo Ybañez	Philippines	Upland Development Program
Russell Yost	U.S.	Univ. Hawaii

Appendix C
African Regional Workshop Program and Participants
Lomé, Togo, 12 - 15 March, 2002

Program

March 11

Participant arrival and registration

March 12

9:00 - 9:30	Opening Ceremonies - Tjark Bontkes
9:30 - 9:45	Description of the COSTBOX project - T. Bontkes
9:45 - 10:00	Description of the NuMaSS project - Jot Smyth
10:00 - 10:15	Break
10:15 - 10:45	Decision aids in soil nutrient management - Hank Breman
10:45 - 11:15	Explanation of QUEFTS - T. Bontkes
11:15 - 12:30	Exercise with QUEFTS - T. Bontkes
12:30 - 2:00	Lunch
2:00 - 3:30	Participants work with QUEFTS using their own data - T. Bontkes
3:30 - 3:45	Break
3:45 - 5:00	Participants continue work with QUEFTS using their own data - T. Bontkes

March 13

8:00 - 9:30	Group Discussion: strengths and weaknesses of QUEFTS - T. Bontkes
9:30 - 10:00	Structure of NuMaSS: diagnosis, prediction, economics and results - J. Smyth
10:00 - 10:15	Break
10:15 - 11:00	Principal algorithms in NuMaSS: acidity, nitrogen and phosphorus - J. Smyth & Russell Yost
11:00 - 12:00	Examples of NuMaSS application - R. Yost
12:00 - 1:30	Lunch
1:30 - 3:00	Participants work with NuMaSS using their own data - J. Smyth & R. Yost

3:00 - 3:15	Break
3:15 - 5:00	Group Discussion: strengths and weaknesses of NuMaSS - J. Smyth & R. Yost
March 14	
8:00 - 8:30	IFDC Phosphate Rock DSS - Charles Yamoah
8:30 - 9:00	Proposed rock phosphate module for NuMaSS - Aminata Sidibe
9:00 - 9:30	Comparison of nutrient predictions in Mali - Adama Bagayoko
9:30 - 10:00	Effects of manure storage on manure quality and maize yield in Zimbabwe - Pauline Chivenge
10:00 - 10:15	Break
10:15 - 10:45	An analysis of ICRISAT long term work on rock phosphate - C. Yamoah
10:45 - 11:15	Economic and social aspects of fertilizer use in the Cinzana region of Mali - Frank Smith
11:15 - 11:45	Relations between C sequestration issues and NuMaSS - R. Yost
11:45 - 1:30	Lunch
1:30 - 3:00	Group discussions on nutrient among countries: I. Benin, Burkina Faso, Gambia, Mali, Senegal, Togo II. Ghana, Malawi, Nigeria, South Africa, Zimbabwe
3:00 - 3:15	Break
3:15 - 5:00	Group discussions on nutrient management by commodities: I. Millet and cowpea II. Peanut and sorghum III. Maize and soybean IV. Specialty crops (cotton and others)
March 15	
8:00 - 10:00	Presentation of reports by country groups
10:00 - 10:15	Break
10:15 - 12:00	Presentation of reports by commodity groups
12:00 - 1:30	Lunch
1:30 - 2:00	A legume cover crop DSS - Robert Carsky

2:00 - 2:30 Final discussion

2:30 - 3:00 Closing ceremonies - IFDC

March 16

Participant departure

Participants

Name	**Country**	**Institution**
M. Adomou	Bénin	INRAB
A. M. Igué	Bénin	CENAP
Amapu	Nigeria	IAR/ABU
V. Chude	Nigeria	IAR/ABU
Gideon Adeoye	Nigeria	Unv. of Ibadan
Samuel Adiku	Ghana	Univ. of Ghana
Agbo Noaméshie	Togo	ITRA
Pacanam	Togo	ITRA-CRAL
Bert Meertens	Togo	IFDC
Ouattara Korodjouma	Burkina Faso	INERA
Pauline Chivenge	Zimbabwe	TSBF
Robert Carsky	Bénin	IITA
Charles Yamoah	Togo	IFDC
Denis Gnakpenou	Togo	IFDC
Francis Tamelokpo	Togo	IFDC
Adama Bagayoko	Mali	IER - Labosep
Aminata Sidibe	Mali	IER - Labosep
Harouna Coulibaly	Mali	IER - Labosep
Sibiri Taonda	Burkina Faso	INERA
Mamadou Khouma	Senegal	ISRA - CNRA

Name	Country	Institution
Modou Sene	Senegal	ISRA - CNRA
Alieu Bittaye	Gambia	NARI
Allan Chilimba	Malawi	Chitedze Agric. Res. Station
Alan Manson	South Africa	Kwazulu-Natal Dept. Agric. & Env. Affairs
Jot Smyth	U.S.	N.C. State Univ.
Frank Smith	U.S.	N.C. State Univ.
Lloyd Hossner	U.S.	Texas A&M Univ.
Richard Kablan	U.S.	Univ. Hawaii
Russell Yost	U.S.	Univ. Hawaii
Pierre Dejean	Togo	IFDC
Tjark Bontkes	Togo	IFDC